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Supplement No. 11

Safety Evaluation Report

related to the operation of
Diablo Canyon Nuclear Power Plant,
Units 1 and 2

Docket Nos. 50-275 and 50-323

Pacific Gas and Electric Company

Supplement No. 11

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

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EVALUATION OF PACIFIC GAS AND ELECTRIC COMPANY'S SYSTEMS INTERACTION PROGRAM FOR SEISMICALLY-INDUCED EVENTS FOR THE DIABLO CANYON NUCLEAR PLANT, UNITS 1 AND 2

1.0 INTRODUCTION

1.1 General

As stated in Supplement Number 9 to the Safety Evaluation Report, the Advisory Committee on Reactor Safeguards (ACRS) requested the applicant to evaluate the consequences of failure of nonseismic equipment and piping interacting with safety systems following an earthquake to determine if the Diablo Canyon plants can be safely shut down following such a postulated accident. The applicant by letters dated May 7, May 27, July 1, July 15, August 10, and September 16, 1980, submitted their response to this matter and the results of our evaluation is presented in this supplement.

1.2 Background

Criteria 2, 3, and 4 of Appendix A to 10 CFR Part 50 require that structures, systems, and components important to safety be able to accommodate natural phenomena such as earthquakes, the effects of fires, and environmental effects without loss of capability to perform their intended safety functions. Also, Appendix A to 10 CFR Part 50 requires that consideration be given to the ability of systems to accommodate single failures without loss of capability to perform their intended safety functions.

As discussed in previous supplements to our Safety Evaluation Report, the structures, systems, and components important to safety of Pacific Gas and Electric Company's (PG&E's) Diablo Canyon Nuclear Plant, Units 1 and 2, have been seismically qualified to withstand a postulated Richter Magnitude 7.5 (7.5M) Hosgri event without loss of capability to perform their intended safety functions. This equipment and its qualification are described in PG&E's document "Seismic Evaluation for Postulated 7.5M Hosgri Event," Amendment 50 to the Diablo Canyon Nuclear Plant Final Safety Analysis Report (referred to hereinafter as the Hosgri report). In addition, the manual equipment relied upon for the suppression of fires at the Diablo Canyon Nuclear Plant has been seismically qualified to withstand the 7.5M Hosgri event without loss of capability to perform its intended function. This equipment and its qualification are described in PG&E's letter to us dated November 13, 1978.

Although many of the nonsafety-related structures, systems, and components at the Diablo Canyon Nuclear Plant have also been seismically qualified to withstand the 7.5M Hosgri event without loss of capability to perform their intended functions, a significant number of them have not. Until recently, little if any explicit consideration has been given to possible seismically induced physical interactions between nonsafety-related structures, systems, and components and those structures, systems, and components required for safety.

It was recognized in NUREG-0585, "TMI-2 Lessons Learned Task Force Final Report," dated October 1979, that even though there is a general requirement that failure of nonsafety-grade equipment or structures should not initiate or aggravate an accident, there is no comprehensive and systematic demonstration that this has been accomplished. The Lessons Learned Task Force concluded in its Recommendation No. 9 that owners of operating plants and all plants under construction should be required to evaluate the interaction of nonsafety and safety-grade systems during normal operation, transients, and design basis accidents to assure that any interaction will not result in exceeding the acceptance criteria for any design basis event.

One aspect of this problem, related to the effects of seismically induced failures on system safety, was discussed with respect to the Diablo Canyon Nuclear Plant at the November 5, 1979 meeting of the Advisory Committee on Reactor Safeguards' Ad Hoc Subcommittee on TMI-2 Accident Implications. As a result of the recommendations made at this meeting, PG&E developed a systems interaction program for seismically induced events (referred to hereinafter as PG&E's program) for their Diablo Canyon Nuclear Plant. The requirement to conduct such a program has subsequently been documented in Task II.C.3, "Systems Interaction," of NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident."

Task II.C.3 of NUREG-0660 provides that the seismic effects study for the Diablo Canyon Nuclear Plant be completed prior to full-power operation. In their letter to us dated May 27, 1980, PG&E has committed to complete their program, including all necessary modifications, for Unit 1 prior to the issuance of any license authorizing full-power operation of that unit. We find this commitment an acceptable method of demonstrating compliance with the requirements of the above cited NUREG Report.

1.3 Overview of PG&E's Program

PG&E's program is described in their document "Description of the Systems Interaction Program for Seismically-Induced Events," Revision No. 4, dated August 29, 1980 (referred to hereinafter as PG&E's report). The stated objective of PG&E's program is to establish confidence that when subjected to seismic events of severity up to and including the postulated 7.5M Hosgri event, structures, systems, and components important to safety shall not be prevented from performing their intended safety functions as a result of physical interactions caused by seismically induced failures of nonsafety-related structures, systems, or components. In addition, safety-related structures, systems, and components shall not lose the redundancy required to compensate for single failures as a result of such interactions.

In order to accomplish their program, PG&E defined as targets all safety-related structures, systems, and components required to safely shut down the plant and maintain the plant in a safe shutdown condition, and certain accident mitigating systems. Initial plant operating modes of normal operation, shutdown, and refueling were considered in the selection of the target equipment. All nonsafety-related structures, systems, and components are defined as sources.

Interactions between source and target equipment are postulated by an interdiciplinary Interaction Team. The Interaction Team postulates interactions during walkdowns of the target equipment using previously established guidance and criteria. These guidance and criteria are discussed in Section 5.0 of this report. The Interaction Team also recommends resolutions to the postulated interactions. The findings of the Interaction Team are evaluated during a subsequent office-based technical evaluation. Any modifications deemed necessary are reviewed after completion by the Interaction Team to ensure that no new interactions are created by the modifications themselves.

PG&E's program is subjected to an independent audit by PG&E's Quality Assurance Department and an independent review by an Independent Review Board which reports its findings to a managing consultant which, in turn, reports its findings to PG&E managment. All documentation associated with PG&E's program is retained in an auditable and retrievable form.

1.4 NRC Staff Review of PG&E's Program

Our review of PG&E's program consisted of a review of their report and the revisions thereto, and an onsite audit of their program. During the course of our review, we participated in a number of meetings and discussions with PG&E representatives concerning their program, its implementation, and the results obtained from it. At our request, PG&E provided additional information as needed for our evaluation. This additional information was provided mainly in the form of revisions to PG&E's report.

Our review of PG&E's report concentrated on (1) the scope of the program, (2) the organization established to implement the program, (3) the methodology employed in the implementation of the program, (4) the criteria and guidance utilized to evaluate possible interactions, and (5) the results obtained from the program. The results of our evaluation of each of these aspects of PG&E's program are presented in Sections 2.0 through 6.0 respectively of this report. The results of our onsite audit of PG&E's program are presented in Section 7.0 of this report. Our conclusion resulting from our evaluation of PG&E's program is presented in Section 8.0 of this report.

Appendix A to this Supplement is a chronology of the principal events involved in the Commission staff's radiological safety review of this matter.

2.0 SCOPE OF PG&E'S PROGRAM

During the course of our review of PG&E's program, we reviewed the scope of equipment considered as targets and the scope of seismically induced physical interactions considered in their program. The results of our evaluations of these matters are presented below.

2.1 Scope of Target Equipment

PG&E's program as originally presented included as target equipment those safety-related structures, systems, and components required to safely shut down the plant from normal operating conditions. We believed that the scope of equipment designated as targets should also include (1) the safety-related equipment required to maintain the plant in a safe shutdown condition; (2) certain accident mitigating systems not already included, such as the containment isolation, main steam isolation, and containment spray systems; and (3) the manual equipment relied upon for the suppression of fires. In addition, we believed that the initial plant operating modes of shutdown and refueling should also be considered in the selection of target equipment. At our request, PG&E revised their report to expand the scope of equipment designated as targets to include those items discussed above. In addition, PG&E referenced the Hosgri report and their November 13, 1978 letter to us on their fire protection system to explicitly define the equipment designated as targets.

We conclude that the revised scope of equipment considered as targets in PG&E's program includes that required to safely shut down and maintain the plant in a safe shutdown condition from all reasonably expected modes of operation and is, therefore, acceptable.

2.2 Scope of Interactions

PG&E's program as originally presented considered only direct physical interactions, in which sources could physically interact directly with targets, and chain-type physical interactions, in which sources could physically interact with other nonsafety-related equipment which, in turn, could physically interact with target equipment. We believed that the scope of interactions considered in the program should also include those in which sources could physically interact with nonsafety-related electrical and pneumatic lines that power or control target equipment with required or assumed failure modes. At our request, PG&E revised their report to expand the scope of interactions considered in the program by including as targets all process tubing, instrumentation, and electrical cables up to the cable trays that are associated with target equipment with required or assumed failure modes. The electrical integrity of the cables in the trays has been demonstrated as indicated in Section 4.5.1.3 of PG&E's report and discussed in Sections 5.3.3 and 5.5.3 of this report.

We conclude that the revised scope of seismically induced physical interactions considered in PG&E's program includes those that could reasonably be expected to occur and is, therefore, acceptable.

3.0 PG&E'S IMPLEMENTING ORGANIZATION

During the course of our review of PG&E's program, we reviewed the organization established to implement their program. A brief description of that organization and the results of our evaluation of it are presented below.

3.1 Description of Organization

The organization established to implement PG&E's program is depicted in Figure 3-1. The principal elements of the organization include (1) the Manager, Nuclear Projects, (2) the Systems Interaction Project Engineer, (3) the Interaction Team, (4) the Quality Assurance Department, (5) the consultants, and (6) the Independent Review Board. These elements of the organization, their responsibilities, and their reporting relationships are described below.

3.1.1 Manager, Nuclear Projects

The Manager, Nuclear Projects is the head of the Nuclear Projects Department. He is responsible for the overall direction of the program including overview of planning, criteria preparation, resolution of problem areas, and participation in preparation of periodic evaluations of program progress. He coordinates the program between PG&E and the managing consultant for the Independent Review Board in addition to coordinating with the Managers, Nuclear Plant Operations and Station Construction, and the engineering chiefs. He reports directly to the Vice-President, Nuclear Power Generation.

3.1.2 Systems Interaction Project Engineer

The Systems Interaction Project Engineer is assigned from the Nuclear Projects Department. He has the direct responsibility for PG&E's program, including writing the program description, coordinating the efforts of consultants working on the program, providing functional and technical direction to the Interaction Team, reviewing and approving the resolutions proposed by the Interaction Team, providing administrative direction for the program, initiating plant modification design changes resulting from the program, preparing reports on the program, and communicating the activities and results of the program to the Manager, Nuclear Projects. He reports to the Manager, Nuclear Projects.

3.1.3 Interaction Team

The Interaction Team is made up of a group of supervisors and engineers drawn from the following disciplines: (a) mechanical systems; (b) piping supports; (c) instrumentation and control; (d) electrical; (e) civil/structural; (f) heating, ventilating, and air conditioning; and (g) startup systems. The Interaction Team members are required to have considerable experience in their field and to have worked on the Diablo Canyon Nuclear Plant. This team is responsible for identifying the target systems, performing the walkdowns, postulating and evaluating potential interactions, and proposing solutions to resolve these interactions in accordance with the guidance and criteria discussed in Section 5.0 of this report. The team members in each discipline are supervised by PG&E senior staff members or, in some cases, by outside

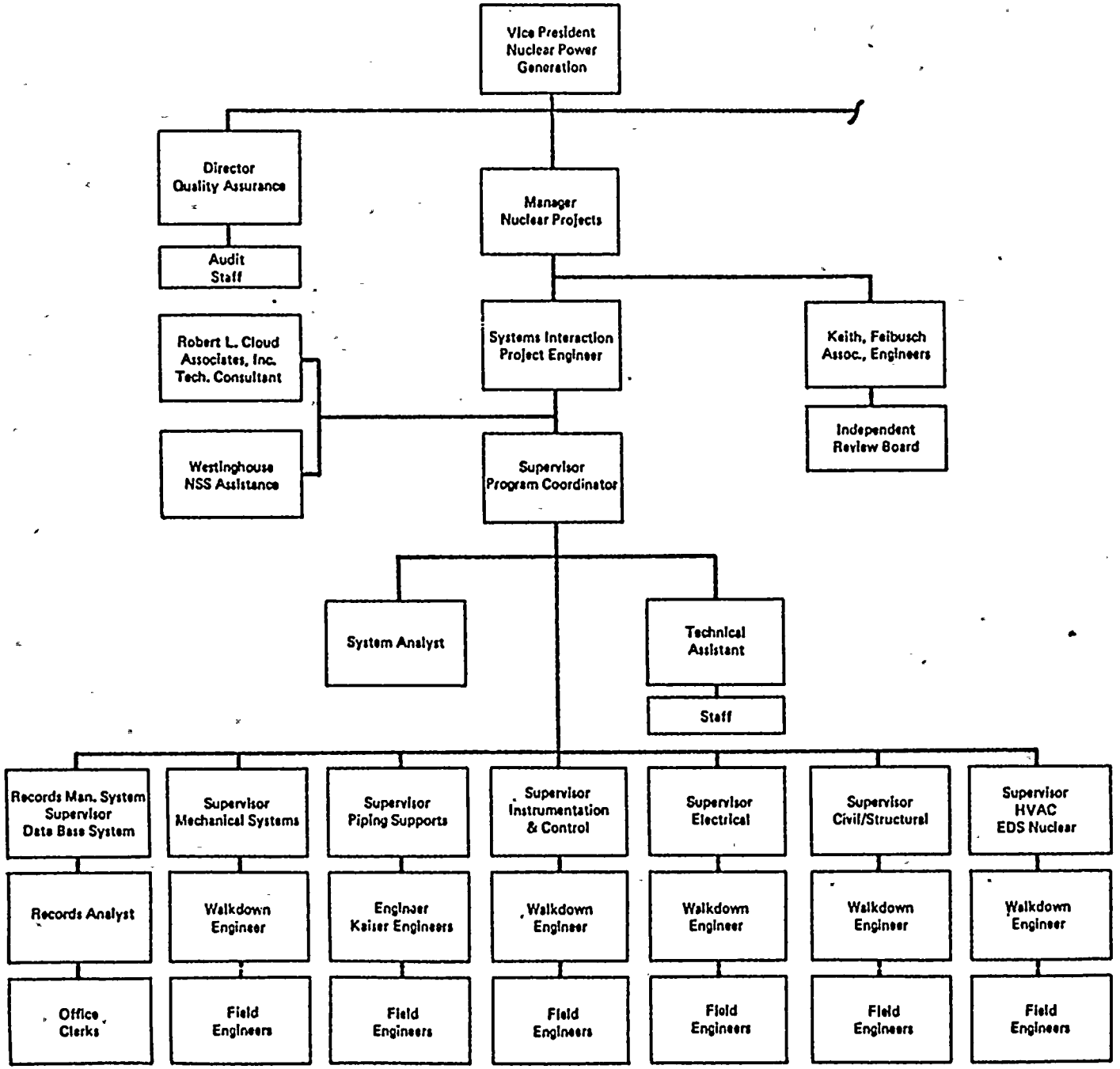

Figure 3-1 PG&E's Implementing Organization

consultants. The team members report through their respective engineering discipline chiefs to the Systems Interaction Project Engineer.

3.1.4 Quality Assurance Department

The Quality Assurance Department is organizationally independent of those departments directly involved in the system interaction program and was, therefore, given the responsibility of providing a team of cognizant engineers that would perform independent audits of the program to verify the correctness and completness of its implementation. The Director of Quality Assurance also directs the activities of the Records Management Section which maintains the relevant records for the Diablo Canyon Nuclear Plant. This section, accordingly, microfilms essential data, records, documents, and drawings associated with the system interaction program and maintains both a computerized index of this microfilmed documentation and a computerized data base of all the identified interactions and their resolutions. The Director of Quality Assurance reports directly to the Vice-President, Nuclear Power Generation.

PG&E's program, including the organization established to implement the program, is subject to PG&E's quality assurance program as described in Section 17 of the Diablo Canyon Nuclear Plant Final Safety Analysis Report. The normal functions and responsibilities of PG&E's Quality Assurance Department as required by Appendix B to 10 CFR Part 50 are not affected by the Quality Assurance Department's involvement with the program, as described above, or by the program itself.

3.1.5 Consultants

PG&E employs several consulting organizations to provide supplementary and specialized services in the performance of their program. These services include providing planning, technical analyses, administrative assistance, and technical assistance. The technical assistance was provided particularly in regard to the resolution of problems involving the nuclear steam supply system. Consulting organizations used in these capacities report directly to the System Interaction Project Engineer. The other use of a consultant was to assemble and manage the Independent Review Board which is described below. The latter consultant reports directly to the Manager, Nuclear Projects.

3.1.6 Independent Review Board

The Independent Review Board consists of five well-established and respected members of the academic and professional nuclear community. The board's function is to review, without any restriction, any aspect of PG&E's program it deems necessary. The board was established and is managed completely independently of PG&E to provide a critical overall review of the program that is as free of corporate (PG&E) restraints as is achievable. The board's conclusions and results are submitted to the managing consultant who, in turn, reports the board's findings to the Manager, Nuclear Projects.

3.2 Evaluation of PG&E's Organization

During the course of our review, we requested additional clarifying information concerning the composition, independence, and scope of review of the independent review team associated with PG&E's Quality Assurance Department and the Independent Review Board. At our request, PG&E revised their report to provide the requested clarifying information.

Our review of the organizational elements established by PG&E to implement their program, their responsibilities, and their reporting requirements has provided us with reasonable assurance that PG&E's program can be implemented in an acceptable manner. Therefore, we conclude that the organization established by PG&E to implement their program is acceptable.

4.0 PG&E'S PROGRAM METHODOLOGY

An important part of our review of PG&E's program, was the examination of the methodology used to implement the program. A brief description of that methodology and the results of our evaluation of it are presented below.

4.1 Description of Methodology

The methodology used by PG&E to implement their program is described below in terms of the initial office activities, field walkdown activities, technical evaluation, and modification phases of the program. Also described are the independent audit and independent review to which the program is subjected. Finally, the documentation associated with the program is described.

4.1.1 Initial Office Activities

The initial office activities phase of the program consisted of (1) the identification of all safety functions required to achieve and maintain the plant in a safe shutdown condition, to prevent or mitigate the consequences of certain postulated accidents, and to suppress fires following the postulated 7.5M Hosgri event; (2) the identification, according to location in the existing plant fire zones, of all structures, systems, and components required to perform these functions (target equipment); (3) the preparation of detailed criteria for the conduct of the program; and (4) the establishment of a documentation data base.

The identification of the safety functions and target equipment was accomplished by PG&E systems engineers with the assistance of systems engineers from Westinghouse Electric Corporation, the nuclear steam supply system vendor for the Diablo Canyon Nuclear Plant, and Robert L. Cloud Associates, technical consultant to PG&E for the program. This information, along with associated information such as equipment failure modes, code classification, PG&E safety classification, and equipment location in the existing plant fire zones, was tabulated in matrix form for use in conjunction with the documentation data base. The target systems were also highlighted on system drawings for use during the walkdowns by the Interaction Team and during the office-based technical evaluation. The existing plant fire zones provided convenient spatial subdivisions (compartments) for the conduct of the program.

The detailed criteria provide bases for (1) the postulation of source equipment failures, (2) the postulation of interaction effects on target equipment, (3) the technical evaluation of postulated interactions, and (4) the resolution of postulated interactions. These criteria are presented in Chapter 4.0 of PG&E's report and are discussed in more detail in Section 5.0 of this report.

The documentation data base is designed to ensure that all postulated interactions and their resolution are documented in a traceable and retrievable manner. This data base also provides a means of maintaining quality control of the program. The documentation data base makes use of and is incorporated into PG&E's existing computerized Records Management System. PG&E's program, including the documentation and record-keeping aspects of the program, is

subject to PG&E's quality assurance program as described in Section 17 of the Diablo Canyon Nuclear Plant Final Safety Analysis Report.

4.1.2 Field Walkdown Activities

The field walkdown activities phase of the program consisted of (1) confirming walkdowns, (2) interaction walkdowns, (3) intercompartmental walkdowns, and (4) modification walkdowns.

Confirming walkdowns, performed after the target equipment was identified and located during the initial office activities phase of the program, provided assurance that the list of target equipment and their locations is accurate and complete.

Interaction walkdowns are performed by the Interaction Team. The team postulates interactions, determines whether the postulated interactions are credible, and documents the following information on interaction documentation forms:

(1) The location and brief description of the postulated interaction,

(2) The equipment involved in the postulated interaction,

(3) The criteria utilized in the postulation of the interaction, and

(4) The recommended resolution of the postulated interaction.

The recommended resolution of the postulated interaction takes one of the following forms:

(1) An evaluation of whether a postulated interaction can or cannot occur,

(2) An evaluation of whether a safety function will be impaired even if a postulated interaction does occur,

(3) A recommendation that a physical modification be designed and installed, or

(4) A recommendation for further evaluation.

All findings and recommendations of the Interaction Team relative to the interaction walkdowns are entered into the documentation data base and are evaluated during the technical evaluation phase of the program.

Intercompartmental walkdowns, i.e., walkdowns in which possible interactions among the various fire zones or compartments are considered, are also performed by the Interaction Team. The team identifies all possible intercompartmental interactions, determines if they are credible, and documents all relevant information in a manner similar to that described above for the interaction walkdown. All findings and recommendations of the Interaction Team relative to the intercompartmental walkdowns are entered into the documentation data base and are evaluated during the technical evaluation phase of the program.

Modification walkdowns are discussed in Section 4.1.4 of this report. Any design deficiencies subject to the requirements of Section 50.55(e) of 10 CFR Part 50 discovered during the program will be reported as required.

4.1.3 Technical Evaluation

All findings and recommendations of the Interaction Team during the interaction and intercompartmental walkdowns were evaluated during the office-based technical evaluation phase of the program. Analyses, testing, and historical experience, when applicable, are used to evaluate the validity of the findings and recommendations of the Interaction Team. The final resolutions of the postulated interactions are documented on the interaction documentation forms and are entered into the documentation data base.

4.1.4 Modifications

Modifications may be deemed necessary as a result of the interaction walkdowns, intercompartmental walkdowns, and subsequent technical evaluation. All design, analysis, and construction work associated with any modifications are subject to PG&E's quality assurance program as described in Section 17 of the Diablo Canyon Nuclear Plant Final Safety Analysis Report. After any modifications have been made, a modification walkdown is performed by the Interaction Team to assure that the modifications themselves will not contribute to adverse interactions. All findings and recommendations of the Interaction Team are entered into the documentation data base..

4.1.5 PG&E Quality Assurance Department's Independent Audit

PG&E's Quality Assurance Department will conduct an independent audit of the program. The audit will be conducted by an interdisciplinary team of engineers who are not involved with the program. This team of engineers will:

(1) Perform, on a sampling basis, walkdowns of representative compartments and any related intercompartmental interactions;

(2) Perform audits of previous intercompartmental walkdowns;

(3) Perform, on a sampling basis, independent analyses to verify that the previous analyses were performed correctly;

(4) Review program documents; and

(5) Review completed modifications.

4.1.6 Independent Review

The Independent Review Board will monitor the program, conduct independent audits, and report its findings to Keith, Feibusch Associates, Engineers, the consultant managing the Independent Review Board. The managing consultant will, in turn, report these findings to PG&E's Manager, Nuclear Projects.

4.1.7 Information Management System

PG&E has provided as an important part of their program, a computerized information management and recording system. This system, when combined with their methods of recording field data and entering it into their computerized system, ensures that complete records of all postulated source failure modes which led to postulated interactions, the resulting interactions, the results of analyses and tests, and the resolutions are maintained in an auditable and retrievable form.

PG&E's method of recording field data is described in Sections 5.4.2, 5.4.3, 5.5, 5.6, and 6.2 of their report and includes the preparation of system and subsystem matrices for each safety-related system and subsystem prior to beginning the walkdowns. During the walkdowns, postulated interactions are documented completely on an Interaction Documentation Sheet. Data from these sheets, the matrices, and the resolution documentation are entered into the computerized documentation data base. All documentation, including the resolution documentation, is microfilmed. A complete index of this information is maintained by the computerized information management system which can retrieve and print out the location of any piece of documentation that has been entered into the system. This location then tells exactly where to look for the information in the microfilm file.

Following the completion of their program, PG&E will prepare a final report which will include an identification of all interactions postulated, all walkdown data, interaction resolutions, and technical reports. PG&E will provide for our information copies of their final report.

4.2 Evaluation of Methodology

During the course of our review, we requested additional clarifying information concerning the methodology used by PG&E to implement their program, especially in the area of the scope of the office-based technical evaluations of the findings of the Interaction Team. We were particularly interested in whether all the findings and recommendations of the Interaction Team, including findings that no interactions were postulated, are reviewed during the technical evaluation phase of the program. At our request, PG&E clarified their report to state that all the findings and recommendations of the Interaction Team are reviewed during the technical evaluation phase of the program.

Our review of the initial office activities, field walkdown activities, technical evaluation, and modification phases of PG&E's program, as well as the independent audit and independent review to which the program is subjected, have provided us with reasonable assurance that PG&E's program can be implemented in an acceptable manner. Therefore, we conclude that the methodology used by PG&E to implement their program is acceptable.

5.0 EVALUATION CRITERIA AND GUIDANCE

5.1 Fundamental Criterion

PG&E adopted as the fundamental basis of their program the criterion that when subjected to seismic events of severity up to and including the postulated 7.5M Hosgri event, the program will demonstrate that the structures, systems, and components important to safety at the Diablo Canyon Nuclear Plant shall not be prevented from carrying out their required safety functions because of physical interactions caused by seismically induced failures of nonsafety-related (source) structures, systems, or components. Nor shall safety-related structures, systems, or components lose the redundancy required to compensate for single failures because of such interactions. We find this fundamental criterion is a reasonable basis for the conduct of the program and is, therefore, acceptable.

5.2 Types of Guidance

In addition to the basic guidance provided by the fundamental criterion, PG&E provided in Section 4.5.1 of their report more specific guidance for the postulation of source failure, the postulation of interactions due to that source failure, the evaluation of the resulting interaction, and the resolution of the interaction. These various types of guidance are discussed in more detail in subsections 5.3, 5.4, 5.5, and 5.6 that follow.

5.3 Source Failure Criteria

5.3.1 Structural Sources

A single criterion for deciding whether significant failure of structures or structural elements can occur was provided. It states that such sources shall be deemed to fail unless it can be shown by test, analysis, or comparison to similar previously qualified structures or elements that they are qualified to withstand the 7.5M Hosgri seismic event. We find this criterion to be consistent with the provisions of Regulatory Guide 1.29 "Seismic Design Classification" and, therefore, acceptable.

5.3.2 Mechanical Sources

A set of six criteria for postulating failure of source mechanical equipment items is presented in Section 4.5.1.2 of PG&E's report. These criteria address overturning of unsupported equipment; failure of valve and operator upperstructures and vertical pump motors; lateral deflection at tops of tanks and vessels; failure of tank or vessel supports; failure of pump and motor anchorages; and other unusual situations that require special consideration through test or analysis. We generally found these criteria acceptable with the exception of the items discussed below where changes in the criteria resulted from our review.

PG&E's criterion for evaluating the overturning of unsupported equipment had been changed to state that if the center of gravity was located higher than a distance equal to the base width, the equipment would be assumed to overturn. This criterion has been revised at our request to now state that such equipment is assumed to overturn if its center of gravity is located higher than a distance equal to or greater than one-half the minimum width of its base with each direction independently evaluated. A horizontal acceleration of at least one g would be required to overturn such an unsupported component. PG&E has advised us that they know of no equipment subject to this criterion that would experience an acceleration greater than one g during the postulated Hosgri event. However, should any such equipment be discovered, it will be evaluated under another criterion which provides that situations not otherwise covered will be analyzed on a case-by-case basis. We believe that PG&E's criterion for evaluating the overturning of unsupported equipment is acceptable.

PG&E's criterion for lateral deflection at the top of tanks and vessels states that the deflection at the top will be postulated to be one inch per foot of tank or vessel height because of sloshing of tank or vessel contents. PG&E has clarified that this deflection is assumed to vary linearly with tank or vessel height. This criterion was developed because of the expressed need for an explicit criterion by the Interaction Team. It is based primarily on engineering judgment, the conservatism of which was demonstrated by example modeling calculations that showed margins of about 100 times between assumed and calculated deflections. We believe this criterion with respect to deflection and resultant potential interaction with other nearby structures and components to be acceptable.

PG&E's criterion for postulating the failure of power-actuated valve operators, vertical pump motors, and gear-operated valve upperstructures that exceed 12 inches in length assumes that these devices will fail unless they have been shown to be seismically qualified. We believe this criterion to be acceptable.

5.3.3 Electrical Sources

For electrical equipment items, identical criteria to those previously stated under mechanical source criteria apply for the cases of unsupported electrical equipment and for support failure of floor-mounted electrical equipment items. These criteria, as well as the criterion for the postulated failure of wall-mounted electrical equipment, we find to be acceptable.

The criterion for raceways originally stated that cable trays would not fail because they were conservatively supported. We had no basis for judging the adequacy of this statement. The criteria were revised to state that vertical supports were required at least every eight feet. All cable tray supports are not stressed beyond the yield point. A series of tests showed that cable trays and supports of the design used at the Diablo Canyon Nuclear Plant would not fail in an earthquake of the Hosgri magnitude. During these tests, it was also shown that no electrical faults developed in the cables. These tests and

their results also applied to both longitudinal and lateral supports. We believe these tests demonstrate that the criterion for postulating cable tray failure provides adequate margins of seismic capability for cable tray systems of this design. We conclude, therefore, that this criterion is acceptable.

Nonsafety-related conduit is supported and restrained by hardware of the same design as that used for Class I, seismically qualified conduit and is, therefore, assumed not to fail. We find this acceptable on the basis that the supports and restraints for nonsafety-related conduits are the same as those for seismically qualified Class I conduit.

5.3.4 Heating, Ventilating, and Air Conditioning (HVAC) Sources

We reviewed the six criteria for postulating failure of HVAC ducting and equipment. We generally found them acceptable with the exception of the concerns discussed below.

For the criteria that treat failure of vertical, lateral, and longitudinal supports, analyses were relied upon to show that if the specified support spacing was adhered to, the supports would not fail under the postulated Hosgri loading. This analysis was not identified nor was its basis given. At our request, PG&E revised their report to identify the analyses and show that the supports are not stressed beyond the elastic limit. The criteria for deflection of ducts appears to be reasonably conservative. The case of failure of inline equipment is stated to be subject to the same criteria as were presented for mechanical sources for failure due to sliding, tipping, falling, or overturning. We believe these criteria, as revised, give a reasonable basis for postulating failure or assessing the seismic margin of safety for these source items and are, therefore, acceptable.

5.3.5 Piping Sources

Eight criteria for postulating failure of piping were presented in PG&E's report. Of these, we found the criteria covering bolted flange separation, failure of fixed-end rod type pipe supports, lateral displacement (sway) of piping, and unusual situations to be reasonably conservative and, therefore, acceptable.

PG&E's report originally attempted to qualify nonsafety-related piping and pipe supports by comparison with historical data or by experience with the same or similar items. We required that the use of such historical or experiential data be carefully controlled so that the compared situations and usage are closely similar, present a complete and unbiased picture, and that the magnitudes of the seismic accelerations are comparable. PG&E has agreed to comply with these requirements and to document such data whenever it is used as a basis for qualification. They further state that such data are expected to be used only to support other bases for qualification. We require that prior approval be obtained for any use of historical data as the sole basis for qualification. On this basis, we find the use of historical data acceptable.

We found that circumferential breaks in threaded piping less than four inches in diameter, all welded piping, and flanged piping were not addressed in the piping failure criteria presented in PG&E's report. The piping failure criteria have been revised to address such failures by considering piping flexibility, heavy fittings, section properties, support spacing, and historical evidence to form a basis for their assumption that such small-diameter, nonsafety-related piping will not fail. We find these revised criteria acceptable.

The criterion for pipe hanger spacing for use where inline equipment or concentrated masses are located between supports was originally that specified in American National Standards Institute (ANSI) Standard B31.1, "Power Piping Code." PG&E responded to our concern about the adequacy of the support spacing by modifying the criterion to require reduced spacing proportionate to the increased mass of the span caused by the added mass of the equipment. We find this modified criterion acceptable.

The effects of high and medium energy line breaks including flooding, jet impingement, pipe whip, and detrimental environmental changes were not originally addressed in PG&E's report. PG&E revised their report to address these effects by including references to high and medium energy line break analyses and to specific flooding analyses that have been previously performed. We find these changes provide reasonable assurance that these effects have been considered and are acceptable.

During our review, we generated several concerns about the adequacy of the criterion for pipe supports and hangers. These included the concern that seismic loads may not have been considered in the evaluation of loading on nonseismically qualified source piping. Section 4.5.1.5 of PG&E's report has been modified to state that the loads selected will be the actual loading and will include seismic loads in addition to the deadweight load. Example calculations will be included in PG&E's final report, as discussed in Section 4.1.7 of this report, to demonstrate the adequacy of the selected load values.

We also questioned the seismic margin to failure for the pipe hangers and supports. PG&E revised their criterion to state that the pipe supports and hangers meet or exceed the ANSI B31.1 Code requirements and that a series of tests have shown that the failure loads were on the order of five times greater than the specified load values. PG&E has also committed to demonstrate the seismic margin in these supports by presenting in their final report several worst-case example analyses of piping and supports to show that the seismically induced strain in the piping and pipe supports will not exceed 25 percent of the minimum specified uniform strain at the point of maximum load. We find that these revisions considered together provide reasonable assurance that the piping and its hangers installed according to this criterion will survive the Hosgri event and are acceptable.

5.3.6 Instrumentation and Control Equipment Sources

In the orginal PG&E report, no criterion was presented for addressing the failure of nonsafety-related instrumentation and control equipment. PG&E modified their report to include a criterion to assume failure of instruments

having extended dimensions greater than 10 inches and masses greater than 45 pounds. Instruments of these dimensions and masses mounted on the least substantial mountings were seismically tested as limiting cases. No structural failures occurred as a result of these tests, which incuded response spectra exceeding the Hosgri spectrum. Therefore, it has been assumed that all instrumentation and control equipment having combinations of mass and extended dimensions less than those in the criterion would not fail. Plant instruments of mass and extended dimensions greater than those in the criterion will be documented as potential interactions. A second criterion covers unusual situations not otherwise covered by stating that such situations will be analyzed on a case-by-case basis. We believe these modifications provide reasonable assurance that instrumentation and control equipment either will not fail or, if failure is assumed, protection against its failure will be provided. We find this acceptable.

5.4 Interaction Identification

PG&E's criterion for identification of interactions states that an interaction shall be identified whenever the seismically induced behavior of a source could lead to detrimental physical effects on a target. Generally, interactions are identified for cases in which: (a) contact between source and target would compromise the operability of the target; (b) source fluid leakage could degrade the target's environment; (c) a source-generated missile contacts the target and compromises the target's pressure boundary; (d) a source-generated missile contacts the target and affects the operability of the target; or (e) secondary or chain-type interactions are caused by any of the above source behavior that affects another piece of nonsafety-related equipment causing it to become, in turn, a source. An interaction is not identified if it can be established through onsite inspection by the Interaction Team that the potential interaction is judged unlikely to occur for seismic events up to and including the 7.5M Hosgri event. We questioned in our review the heavy dependence that is placed on the exercise of engineering judgment on the part of the members of the Interaction Team in the postulation and identification of interactions. PG&E modified their report to specifically instruct the Interaction Team that in case there was any uncertainty on the part of the team regarding the likelihood of occurrence or the potential effects on the target of a postulated interaction, it was to be referred for further study and analysis in the office. We believe that this guidance represents a reasonable and sufficient basis for identification of potential physical interactions due to seismic excitation and is, therefore, acceptable.

5.5 Interaction Effects Evaluation

5.5.1 Evaluation of Interactions

Evaluation of the effects of seismically induced postulated interactions can have three possible outcomes: (1) a seismic event may not cause a source failure that leads to an interaction because the potential source can be shown by analysis, test, or experience with the same or similar items to be capable of withstanding seismic events of severity up to and including the 7.5M Hosgri event; (2) a seismic event may cause damage or failure of the source item, but

the credible failure modes do not pose threats to the integrity or operability of the target; or (3) a seismic event may cause damage or failure of the source item that can lead to an adverse interaction with a safety-related system.

Item (1) is evaluated using the source failure criteria listed in Section 4.5.1 of PG&E's report and discussed in Section 5.3 of this report. We believe this approach is straightforward and acceptable.

Item (2) relies heavily on the engineering judgment of the walkdown team as discussed in preceding Section 5.4 of this report. Further confidence in this regard is given by the provision that all field interaction evaluations and resolutions are subjected to an office-based technical evaluation. The integrity and quality of this approach is backed up by the independent audits performed by the auditing team from PG&E's Quality Assurance Department as described in Section 4.1.5 of this report and by the Independent Review Board as described in Section 4.1.6 of this report. We believe that this system of reviews provides reasonable assurance that all interactions will receive appropriate consideration and is acceptable.

Item (3) leads to consideration of two types of interactions, direct as discussed below in Section 5.5.2 and indirect as discussed in Section 5.5.3 of this report.

5.5.2 Evaluation of Direct Interactions

Criteria for evaluating direct physical interactions are presented in Section 4.5.2.1 of PG&E's report. This presentation refers to criteria for evaluating the direct impact of missiles or falling objects on safety-related structures and components that are contained in Sections 3.3.2 and 3.5 of the Diablo Canyon Final Safety Analysis Report and in ANSI Standard N660, "Plant Design Against Missiles." These criteria were previously found acceptable for evaluating the design of safety-related structures and components; therefore, we find their present use acceptable.

Direct impact of missiles and falling objects onto HVAC ducting is evaluated using the values of revised Table 4-5-3 contained in PG&E's report. The ducts have been evaluated to absorb these values of kinetic energy while suffering local deformation of no more than 20 percent of the duct diameter or smallest dimension. The ducting has been sized such that a loss of this magnitude will not cause loss of the required flow through the duct. Also the ducting support has been shown to remain stressed within the elastic limit. We believe these criteria are sufficiently conservative to provide reasonable assurance that this ducting will not fail to perform its function when struck by missiles having impact energies no greater than those tabulated in the table and are, therefore, acceptable.

Dynamic effects of breaks in piping are evaluated using the criteria given in Section 3.6 of the Diablo Canyon Final Safety Analysis Report. These criteria were previously found acceptable for evaluation of these effects for safety-related equipment and we find their use in this evaluation acceptable.

Criteria for evaluating the flooding effects of broken or leaking piping are presented in Appendix 3.6A of the Diablo Canyon Final Safety Analysis Report. These criteria were previously found acceptable for evaluating these effects on safety-related equipment; therefore, we find their present use acceptable.

Environmental effects of broken or leaking piping, tanks, or pressure vessels are evaluated by comparing the estimated environment with the qualification profile of the target component or structure. PG&E has stated that criteria and data contained in Section 3.11 of the Diablo Canyon Final Safety Analysis Report will be used to estimate the resulting environment and to guide comparison with the qualification profile. We find this acceptable since this use of these criteria and data has been previously found acceptable for qualifying safety-related equipment.

5.5.3 Evaluation of Indirect Interactions

Two types of indirect interactions are considered in PG&E's program. First is the chain or successive failure type interaction described in Section 5.4 of this report in which primary source failure is first postulated. Next, the direct interaction evaluation criteria are applied between the failed primary source and the nonsafety-related equipment that is postulated to be the target. The target now becomes the secondary source, is postulated to fail, and the direct interaction evaluation criteria are applied again between the secondary source and the target safety-related equipment. We find that this application of the direct interaction evaluation criteria to these successive chain-type interactions is reasonably conservative and is, therefore, acceptable.

The second type of indirect interaction is that where failure of source equipment could cause interactions such as the non-operation or inadvertent operation of nonsafety-related equipment that has required or assumed failure modes. Similar interactions could occur where safety-related equipment items are supplied by nonvital power sources when these nonvital power sources are lost, degraded, or when unwanted energization violates the design assumption of loss of such nonvital power. At our request, PG&E revised their report to consider this type of potential indirect interaction. The revision states that the walkdowns will assure that air and process tubing, and instrumentation, control, and electrical cables up to the cable trays will be protected from physical damage due to inadequate support or other postulated interactions. These walkdowns and subsequent evaluations will be based on consideration of these items as targets and on analyses which show no significant interaction effect; or on action taken to prevent such interactions from occurring. Once the cables enter the cable tray system, further consideration is not considered necessary since even the nonsafety-related cable trays have been shown to withstand the Hosgri event; tests have shown that the cables in trays subjected to seismic excitation equivalent to that of the Hosgri event have not sustained significant damage; and cable tray locations are such that significant damage to cabling in the trays from falling objects is minimal. We find these provisions provide reasonable assurance that localized failures of nonsafety-related equipment or structures will not cause interactions of the types considered above and are acceptable.

5.6 Resolution Guidance

5.6.1 Methods of Resolution

PG&E's report presents four methods of resolution of identified interactions. These are: (1) show that the source will not fail, (2) show that the operability of the target is not impaired, (3) modify the source or target to prevent the interaction from affecting the target, and (4) reorder the operating procedures or define alternate means of providing the required safety functions. In Section 5.6.2 below, we discuss the acceptability of the guidance or criteria that are available for use in evaluating resolutions achieved by each of these four methods.

5.6.2 Evaluation of Resolution Guidance

To resolve postulated interactions by showing that the source will not fail, use is made of the source failure criteria that are presented in Sections 4.5.1.1 through 4.5.1.6 of PG&E's report. These criteria were evaluated and found acceptable in Sections 5.3.1 through 5.3.6 of this report. If the source can be shown to meet or exceed the requirements of these criteria, no interaction can occur and the situation is resolved. We find this use of the source failure criteria acceptable.

To resolve postulated interactions by showing that the operability of the target is not impaired, use is similarly made of the interaction evaluation guidance presented in Sections 4.5.2.1 and 4.5.2.2 of PG&E's report and discussed in Sections 5.5.2 and 5.5.3 of this report. The interaction and its effects on the target are compared against these guidelines and if a determination can be made that the target will retain its required degree of operability regardless of the interaction, then the situation is deemed resolved on the basis that the target operability has not been impaired. We find this use of the interaction evaluation guidance acceptable.

Should analysis or test not provide a reasonable means of resolving the interaction, physical modifications to either source or target may be necessary. These modifications may first take the form of bracing, supporting, or reinforcing of the source to preclude its failure. Physical modification of the target to retain the required degree of operability regardless of the interaction is the second means of resolution. Providing physical shielding of the target or relocation of either source or target to preclude the physical interaction is the third means of resolution by modification.

For modification of either source or target, the criteria for evaluating the acceptability of the structural or mechanical modifications are the same as those documented in the Hosgri report for safety-related structures and equipment. Relocation of either source or target equipment must similarly meet the criteria for separation and maintenance of independence of redundant systems and structures for safety-related systems and structures. Erection, composition, and placement of physical shielding structures must also meet the requirements for structural and mechanical integrity as documented in the Hosgri report as well as the requirements of the fire protection program. Finally, the modified and/or

relocated equipment or structures must meet the requirements of the PG&E Quality Assurance program as well as the criterion that when reevaluated for interactions using the previously approved criteria and guidance, they must be found to have not only resolved the original interaction but also to have not created any new interactions. We find that use of this guidance and criteria in this manner is acceptable.

No specific guidance or criteria are provided for the last means of resolution, namely that of reordering the operating procedures or defining alternate means of providing the required safety functions. PG&E has stated that this means of resolution was included for completeness and that they are unaware of any situations in which it might be applied. We require that if this means of resolution is adopted, specific acceptance criteria for each situation shall be provided and evaluated for each such unique case. On this basis we find this last means acceptable.

5.7 Evaluation of Program Criteria and Guidance

Our review of the criteria and guidance used by PG&E to evaluate seismically induced systems interactions has provided us with reasonable assurance that PG&E's program can be implemented in an acceptable manner. Therefore, we conclude that the criteria and guidance used by PG&E to evaluate seismically induced systems interactions are acceptable.

6.0 RESULTS OBTAINED BY PG&E UP TO AUGUST 1, 1980

At our request, PG&E provided us with a summary of the results of their program obtained up to August 1, 1980. A brief description of those results and our evaluation of them are presented below.

6.1 Description of Results

As of August 1, 1980, PG&E had completed approximately 90 percent of their walkdown effort associated with Unit 1. Up to that time, a total of 677 interactions had been postulated. Most of the postulated interactions involved structural grates, platforms, and handrails; pipe; and electrical lighting fixtures. Other postulated interactions involved HVAC equipment, pipe supports, service hoists, pipe whip restraints, ladders, conduit and wire, pipe insulation, and tanks and vessels. A breakdown by category of these interactions is presented in Table 6-1.

Of the 677 postulated interactions, 207 were resolved in the field by the Interaction Team. The remaining 470 postulated interactions were deemed to require further resolution effort. Of the 470 postulated interactions deemed to require further resolution effort, 242 were resolved by analyses or tests, and 228 were resolved by plant modifications.

6.2 Evaluation of Results

Although not yet complete, PG&E's program has resulted in the postulation of a substantial number of interactions. Approximately one-third of the postulated interactions were resolved in the field by the Interaction Team; the remaining two-thirds required further resolution effort. Of those postulated interactions requiring further resolution effort, approximately one-half were resolved by analyses or tests, and one-half were resolved by plant modifications. Approximately one-third of the total number of interactions postulated were ultimately resolved by plant modifications.

We believe that (1) the substantial numbers of interactions postulated and (2) the significant fraction of those postulated interactions that were ultimately resolved by plant modifications provide reasonable assurance that the objectives of PG&E's program can be achieved.

TABLE 6-1

BREAKDOWN BY CATEGORY OF

INTERACTIONS POSTULATED UP TO AUGUST 1, 1980

Category of Postulated Interaction	Number of Postulated Interactions
Structural Grates, Platforms, and Handrails,	199
Pipe	178
Electrical Light Fixtures	164
HVAC Equipment	33
Pipe Supports	31
Miscellaneous	31
Service Hoists	16
Pipe Whip Restraints	9
Ladders	7
Conduit and Wire	3
Pipe Insulation	3
Tanks and Vessels	3
Total	677

7.0 ONSITE AUDIT OF PG&E'S PROGRAM

An important part of our review of PG&E's program was a three-day onsite audit. Assisting us in this effort were the NRC Resident Inspector for the Diablo Canyon Nuclear Plant and a representative of Lawrence Livermore Laboratory, our consultant for the review. The objectives of our audit were to (1) continue our discussions with PG&E related to our review of their program, (2) review the progress made to date by PG&E, (3) observe PG&E's walkdown technique and examples of postulated interactions identified during previous walkdowns, and (4) conduct independent walkdowns of selected portions of some of the safety-related systems.

Our audit began with a tour of the plant to familiarize ourselves with the location and layout of the major plant structures, systems, and components. Following this tour, PG&E representatives briefly described their program and summarized the progress made to date. Included in this presentation was a discussion of the responses of piping, cable trays, and other equipment located at certain fossil power plants and industrial facilities to some past and recent seismic events.

The PG&E representatives then demonstrated how interaction data from the program is documented in the field and subsequently entered into the data base of their computerized information management system. Resolution information developed subsequent to the walkdowns can also be readily entered into the system for each identified interaction. They also demonstrated the search and retrieval capabilities of the system. We found this system to be an important part of the program.

We observed a demonstration of PG&E's walkdown technique and were shown examples of postulated interactions that had been identified on previous walkdowns. The PG&E representatives also discussed with us the resolutions of these sample interactions.

We next conducted our own independent walkdowns of selected portions of some of the plant safety-related systems. In this effort, experienced PG&E engineering personnel assisted us in locating and tracing down the various elements of the selected portions of the safety-related systems as well as in identifying any nonsafety-related structures, systems, or components that appeared to constitute an interaction.

These portions of systems were walked down in an effort to identify potential sources of seismically induced physical interactions. The walkdowns consisted of physically investigating the routing and installation of all piping, conduit, and discrete equipment units that formed the portions of the systems under consideration. At each point during this process, the safety-related system was viewed as the target. All nonsafety-related systems that either joined the target, were located nearby, or were located such that their failure could affect the ability of the safety-related system to perform its intended function were assumed to be potential sources of interaction. Safety-related systems located nearby were assumed not to fail since they are seismically qualified. Although potential physical interactions involving only safety-related systems

are outside the scope of the program, PG&E has noted a few such interactions. These noted interactions either have been or will be eliminated.

The portions of systems we selected for our independent walkdowns included (1) the turbine steam supply piping, electrical power supply to the turbine motor-operated throttle valve, and the pump discharge piping associated with the turbine-driven auxiliary feedwater system; (2) the pressurizer relief tank rupture disks; (3) the containment ventilation and purge isolation valves; and (4) one 125-volt vital battery room. The results of our independent walkdowns are discussed below.

We found that our method of conducting a walkdown was nearly identical to PG&E's earlier efforts in that our philosophy of considering the safety-related systems as targets and the nonsafety-related systems as sources were the same. PG&E had subsequently refined their data gathering and recording system to the point where each postulated interaction is uniquely identified and described. This information, along with information about its resolution, is documented in retrievable form in a computer-based data management system.

After our walkdowns were completed, we compared our results to those of PG&E that contained the same elements. The comparison was limited in extent because PG&E had not completed their walkdowns of the containment ventilation and purge system isolation valves or the electrical power supply to the turbine motor-operated throttle valve. The results of our independent walkdowns were consistent with those of PG&E; that is, we identified all of the interactions postulated by PG&E during their walkdowns and no others.

The results of our walkdowns of each of the selected portions of the systems listed above are described below.

(1a) The turbine-driven auxiliary feedwater pump turbine steam supply piping was walked down from its connections to Main Steam Supply Lines 2 and 3 to the turbine itself. Six interactions with this piping were postulated. An example of a postulated interaction involved a stub drain line from that portion of the turbine steam supply line that came from Main Steam Supply Line 2. The stub drain line was found to extend over a nonseismically qualified steam drain line in such a manner that it could be either impacted by the steam drain line or be struck from above and be broken off. PG&E's recommended resolution was to cut off and cap the stub drain line since these lines are not needed for plant operation.

(1b) The electrical power supply to Turbine Motor-Operated Throttle Valve FCV-95, routed in safety-related Conduit K-6764, was walked down from the valve operator to its point of entrance into the motor control center in the 480-volt essential switchgear room. We postulated some 15 interactions, most of which involved nonsafety-related conduits crossing Conduit K6764 with minimal physical separation. In these cases, the nonsafety-related conduits either were or will be seismically supported. The most glaring postulated interaction involved a two-inch plant air supply line that loops around the Component Cooling Water Train "A" header surge line and runs vertically between Conduit K-6764 and the compartment walls with

about one-inch separation between the conduit and the nonsafety-related air supply line. The air supply line was not restrained over any of its length in the vicinity of the crossover and was observed to impact heavily on Conduit K-6764 when the air line was shaken by hand. PG&E's recommended resolution was to seismically support and restrain the air supply line to prevent this motion.

(1c) We walked down the turbine-driven auxiliary feedwater pump discharge piping from its connection at the pump to its connection to the main feedwater lines. Nine interactions with this line and its valving were postulated. An example of a postulated interaction was the seismically induced movement of the discharge leg (Line 570) that feeds Steam Generator 2 into a nonsafety-related angle bracket pipe support for a 3/4-inch test line. PG&E's recommended resolution was to cut out the angle bracket to increase the clearance for Line 570 from 3/16 to two inches, thus providing adequate allowance for motion of Line 570.

(2) We investigated the location and construction of the pressurizer relief tank rupture disks. The two disks, approximately 12 inches in diameter, are located on top of the pressurizer relief tank. We postulated that rupture of these disks could affect four Class IE conduits and associated pull or junction boxes that were located on the ceiling about eight feet above the top of the tank. Upon further investigation, we found that these disks were designed to rupture in a tearing mode into pie-shaped sections resembling the opening of flower petals at a maximum pressure of 112 psig. It is judged highly unlikely that missiles or shrapnel would be formed by this mode of failure. Further, the maximum temperature of 118 degrees Fahrenheit would not pose a thermal hazard to the cabling in the conduits and boxes. Three of the boxes were pull boxes with the cabling insulation left intact. The fourth box contained a splice which was made using environmentally qualified Raychem splicing materials. We concluded that this postulated interaction does not require further action.

(3) We investigated potential interactions involving the containment ventilation and purge system isolation valves. These are large (48-inch) butterfly valves that close upon deenergization of the nonsafety-grade control air supply. We were particularly interested in whether potential interactions could damage the solenoid air control valves preventing them from venting the air from the actuator thus preventing the valves from achieving their required closed failure modes. An inspection of the solenoid air control valves and the surrounding area did not reveal any postulated interactions.

(4) Our review of one of the 125-volt vital battery rooms revealed only one category of postulated interaction. The overhead lighting fixtures were not seismically supported. We postulated that these fixtures could fall onto the battery racks and short out the cells, ground the battery, or break the cell containers. PG&E's recommended resolution was to seismically support the fixtures.

8.0 CONCLUSION AND FOLLOWUP

8.1 Conclusion

Our review of PG&E's report, as described in Sections 2.0 through 5.0 of this report; our evaluation of the results of PG&E's program obtained up to August 1, 1980, as described in Section 6.0 of this report; and our onsite audit of PG&E's program, as described in Section 7.0 of this report, have provided us with reasonable assurance that when subjected to seismic events of severity up to and including the postulated 7.5M Hosgri event; structures, systems, and components important to safety will not be prevented from performing their intended safety functions as a result of physical interactions with nonsafety-related structures, systems, and components. In addition, safety-related structures, systems, and components will not lose the redundancy required to compensate for single failures as a result of such interactions. Further, our review has provided us with additional assurance that the requirements of Criteria 2, 3, and 4 of Appendix A to 10 CFR Part 50 and the single failure requirements of Appendix A to 10 CFR Part 50 have been met for the Diablo Canyon Nuclear Plant, Units 1 and 2. Therefore, we conclude that PG&E's program is acceptable.

8.2 Followup.

As stated above, we, the Office of Nuclear Reactor Regulation, have concluded that PG&E's program is acceptable. PG&E will complete their program and any necessary plant modifications for each unit prior to the issuance of any license authorizing full-power operation of that unit. The completion of PG&E's program and the acceptability of any plant modifications will be verified by the Office of Inspection and Enforcement during the normal course of their inspection activities. Finally, PG&E will, following the completion of their program, provide for our information copies of their final report of their program which will include an identification of all interactions postulated, all walkdown data, interaction resolutions, and technical reports.

APPENDIX A

May 7, 1980	Submittal concerning the Systems Interaction Program
May 27, 1980	Submittal concerning the Systems Interaction Program
July 1, 1980	Submittal concerning the Systems Interaction Program
July 15, 1980	Submittal concerning the Systems Interaction Program
August 19, 1980	Submittal concerning the Systems Interaction Program
September 16, 1980	Submittal concerning the Systems Interaction Program

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Supplement No. 11 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate the Diablo Canyon Nuclear Power Station (Docket Nos. 50-275 and 50-323) located in San Luis Obispo County, California has been prepared by the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission. The purpose of this Supplement is to discuss the systems interaction program for seismically-induced events for the Diablo Canyon facilities.

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